(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 November 2001 (22.11.2001)

PCT

(10) International Publication Number
WO 01/88042 A1

(51) International Patent Classification[7]: C08L 101/12, B32B 27/32, H01B 7/17

(21) International Application Number: PCT/KR01/00787

(22) International Filing Date: 16 May 2001 (16.05.2001)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
2000/26253 16 May 2000 (16.05.2000) KR

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

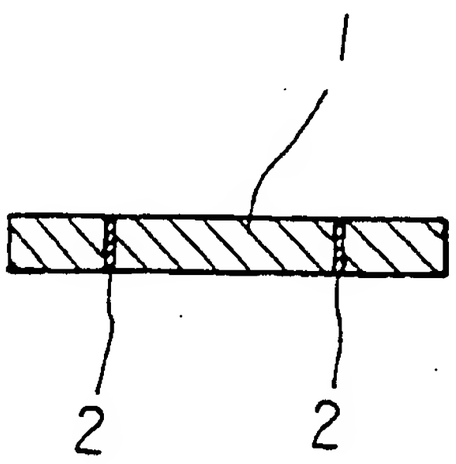
(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/88042 A1

(54) **Title:** ORGANIC SEMI-CONDUCTIVE COMPOSITION AND SENSOR



(57) **Abstract:** An organic semi-conductive agent composition and a sensor using the same, intended to detect species and content of organic compounds. The organic semi-conductive composition comprises 54 wt% of EEA, 39 wt% of conductive carbon black, 0.25 wt% of antioxidant, 6 wt% of dispersing agent, and 0.75 wt% of cross-linking agent, and the sensor using the said organic semi-conductive agent composition is formed by separately planting two electrodes on a base resin comprised of the aforementioned composition. The sensor operates by checking the resistance value between the two electrodes over a lapse in time.

ORGANIC SEMI-CONDUCTIVE COMPOSITION AND SENSOR USING THE SAME

[Field of the Invention]

The present invention relates to an organic semi-conductive agent composition and sensor using the same, intended to be used for determining species and content of organic compounds.

[Background of the Invention]

In case of organic compounds, it is impossible to verify their chemical species with the naked eye or with a simple reagent, thus it needs to primarily, collect and transfer samples to a lab, and decide their species by using an expensive gas chromatography apparatus, for precise determination.

The above method includes some problems, for example: firstly, long periods of time taken for determining their species as there is no way to carry out *in situ* determination; secondly, use of an expensive gas chromatography apparatus, and thirdly, need for highly intellectual human resources.

[Detailed Description of the Invention]

The present invention is intended to determine species of organic

compounds *in situ*, in a short period of time with ease, in particular it determines species and content of organic compounds by measuring increased volume levels of an organic semi-conductive agent, which is represented by resistance value, wherein the volume of the organic semi-conductive agent depends upon species and content of organic compound which it contacts.

Such organic semi-conductive agent composition according to the present invention comprises 54 wt% of EEA, 39 wt% of conductive carbon black, 0.25 wt% of antioxidant, 6 wt% of dispersing agent, 0.75 wt% of cross-linking agent, and a sensor using the said organic semi-conductive agent is formed by separately planting two electrodes on a base resin comprised of above-mentioned composition. The sensor operates by checking resistance value between the two electrodes over a lapse in time.

[Brief Description of the Figures]

Figure 1 shows a side view of a feature of a sensor according to the present invention.

Figure 2 shows a cross-sectional view of a sensor according to the present invention.

Figure 3 shows a schematic view describing variation of resistance value from the sensor according to the present invention, with time.

[Description of Symbols represented in Figures]

1 : base resin 2 : electrode

[Examples]

Organic semi-conductive agent composition according to the present invention is prepared into a base resin, by mixing 54 wt% of EEA, 39 wt% of conductive carbon black, 0.25 wt% of antioxidant, 1 wt% of dispersing agent A and 5 wt% of dispersing agent B, 0.75 wt% of cross-linking agent.

EEA used herein, means poly(ethylene-co-ethacrylate), in particular having 15% of ethacrylate content, and 0.7 of MI (Melt Index), for example a commercially available product EEA A710 (trade name) which is manufactured by Mitui Dupont (Japan) can be used herein.

Conductive carbon black used herein, is Actylene Black type, for example a commercially available product DENKA BLACK (trade name) which can be obtained from DENKA (Japan) can be used herein.

Antioxidant used herein, means 4,4'-Thiobis(6-tertbutyl-m-cresol), for example a commercially available product Santonox R (trade name) which is manufactured by Monsanto (USA) can be used herein.

Dispersing agent A used herein, represents Silicon wax, for example a

commercially available product Struktol WS 180 (trade name) which is manufactured by Schill Seilacher (Germany) can be used herein, and dispersing agent B used herein, represents polyethylene wax, for example a commercially available product LC 102N (trade name) which is manufactured by Lion Chemicals can be used herein.

Cross-linking agent used herein, represents 1,4-bis(t-butyl peroxy isopropyl)benzone, for example a commercially available product Perbutyl-P (PBP) (trade name) which is manufactured by Nippon Oils & Fats Co can be used herein.

Base resin according to the present invention, that is organic semi-conductive agent, is prepared from aforementioned components, including 54 wt% of EEA, 39 wt% of conductive carbon black, 0.25 wt% of antioxidant, 1 wt% of dispersing agent A and 5 wt% of dispersing agent B, 0.75 wt% of cross-linking agent, and the base resin has a characteristic property such that its volume is being increased when immersed in organic compounds, and the increased volume level depends upon species and content of organic compounds.

Such can be used as EEA in the composition of the invention includes high molecular compound or rubber and the like having polar functional group, as well as VLDPE having a density in the range of 0.85 to 0.90 and MI (Melt Index) in the range of 0.5 to 10 or metallocene catalyst. The said compounds can be used alone or two or more combinations thereof in preparation of base resin.

More specifically, when EEA and EVA is used, the amount of EA or VA should be in the range of 10 ~ 30%, with MI of 0.5 ~ 10, and either or both of acetylene black type and furnace black 2 type can be used as conductive carbon black.

Acetylene black is more suitable for use as it has less impurities, but Furnace black may be used herein, and both of them can be used in combination.

Optionally, Metal Oxide (MgO) and the like can be added, and dicumyl peroxide (DCP) also can be used as a cross-linking agent.

When the base resin with the above composition is placed in organic compound, its volume increases variably according to the chemical species and content of the organic compound, and the degree of volume increase can be measured as resistance value to determine the species and content of the subject organic compound.

Now, a sensor using such base resin of the present invention for determining the species and content of organic compounds is described below.

Base resin (1) as showed in Figure 1 is prepared by using the composition of the present invention, in suitable size, for example with a width and length of 2 ㎝ and thickness of 3 ㎜.

To the base resin (1), SUS electrodes (2) having 0.7 ㎝ in length are formed with an interval of 1 ㎝, as shown in Figure 1, and a resistance meter is connected to

the said electrodes (2) so as to measure the resistance value.

When placing such base resin (1) into subject organic compounds, initially resistance value measured at the electrodes (2) is nearly 0, as conductive carbon black contained in the base resin (1) forms electron transfer pass.

However, as time passes, resistance value measured at the electrodes is raised as the volume of the base resin (1) increases according to the species and content of subject organic compounds.

In other words, the resistance value increases as the distance between conductive carbon blacks becomes longer unlike the initial stage.

Resistance value detected at the electrodes (2) according to species and content of organic compounds is shown in Figure 3, thus it is possible to determine species of organic compounds by using the composition and sensor of the present invention.

In an embodiment of the present invention, the time to reach 1000 Kohm was, 7.5 minutes for gasoline, 3 minutes for gasoline containing 20% of toluene and 6.2 minutes for gasoline containing 10% of toluene, and 8.5 minutes for gasoline containing 5% kerosene, 9 minutes for gasoline containing 10% kerosene and about 10 minutes for gasoline containing 20% kerosene.

Therefore, it is possible to determine the species and content of a certain organic compound by checking the time, which takes to reach 1000 Kohm, or to 500

Kohm in order to save time, after placing the base resin (1) into a subject organic compound.

As the present invention makes it possible to determine the species and content of organic compounds by using base resin of which volume is increased when contacting with the subject organic compound and checking the time for the resistance value to reach a defined value, it takes a shorter time without using such expensive apparatus.

In the present invention, it is possible to obtain the same result by measuring the degree of increased volume, or the increased length of base resin. Also, with the present invention, it is possible to measure the degree of degradation, i.e. oxidation of various organic compounds, in particular to investigate degree of soil pollution and its pollutant in investigating whether soil is polluted or not, and in the former case, investigating the degree of pollution.

[Industrial Applicability]

The present invention relates to a base resin, which is made into a composition comprised of 54 wt% of EEA, 39 wt% conductive carbon black, 0.25 wt% of antioxidant, 1 wt% of dispersing agent A, 5 wt% of dispersing agent B, and 0.75 wt% of cross-linking agent and has a characteristic such that the volume changes when contacting with organic compound. Also, it relates to the method for

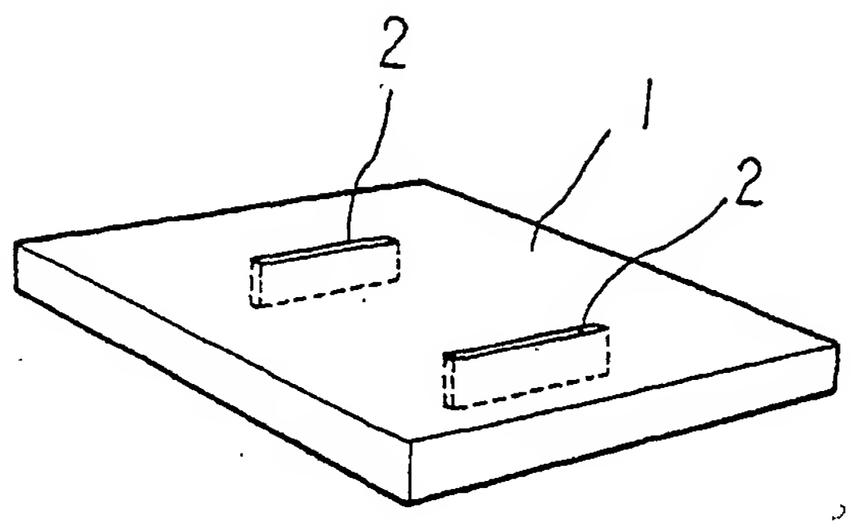
determining species and content of organic compound by using the above said characteristic which shows different degrees of increased volume which is represented by the resistance value of the base resin according to the species and content of organic compounds, when it is placed into a subject organic compound. The present invention can verify species and content of organic compounds in the shortest time with a simple method, and investigating soils in a certain area, particularly determining the presence of organic compounds, content and species.

What is claimed is:

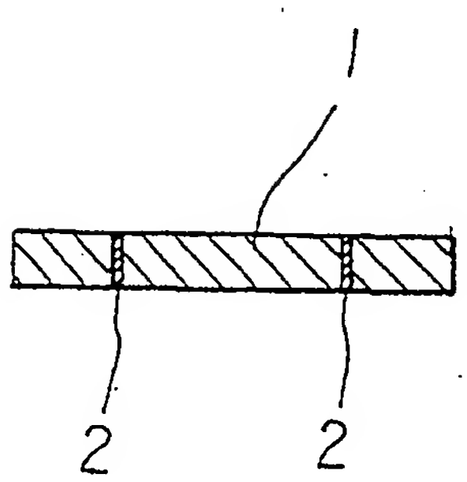
1. Organic semi-conductive composition comprises a high-molecular weight compound having polar functional group, conductive carbon black, antioxidant, dispersing agent A (silicon wax) and dispersing agent B (polyethylene wax), and cross-linking agent.

2. Sensor using the organic semi-conductive composition according to the claim 1, formed by separately planting, with a certain interval, two electrodes (2) on a base resin (1), wherein the base resin (1) is prepared with 54 wt% of a high-molecular weight compound having polar functional group, 39 wt% of conductive carbon black, 0.25 wt% of antioxidant, 1 wt% of dispersing agent A (silicon wax) and 5 wt% of dispersing agent B (polyethylene wax), and 0.75 wt% of cross-linking agent.

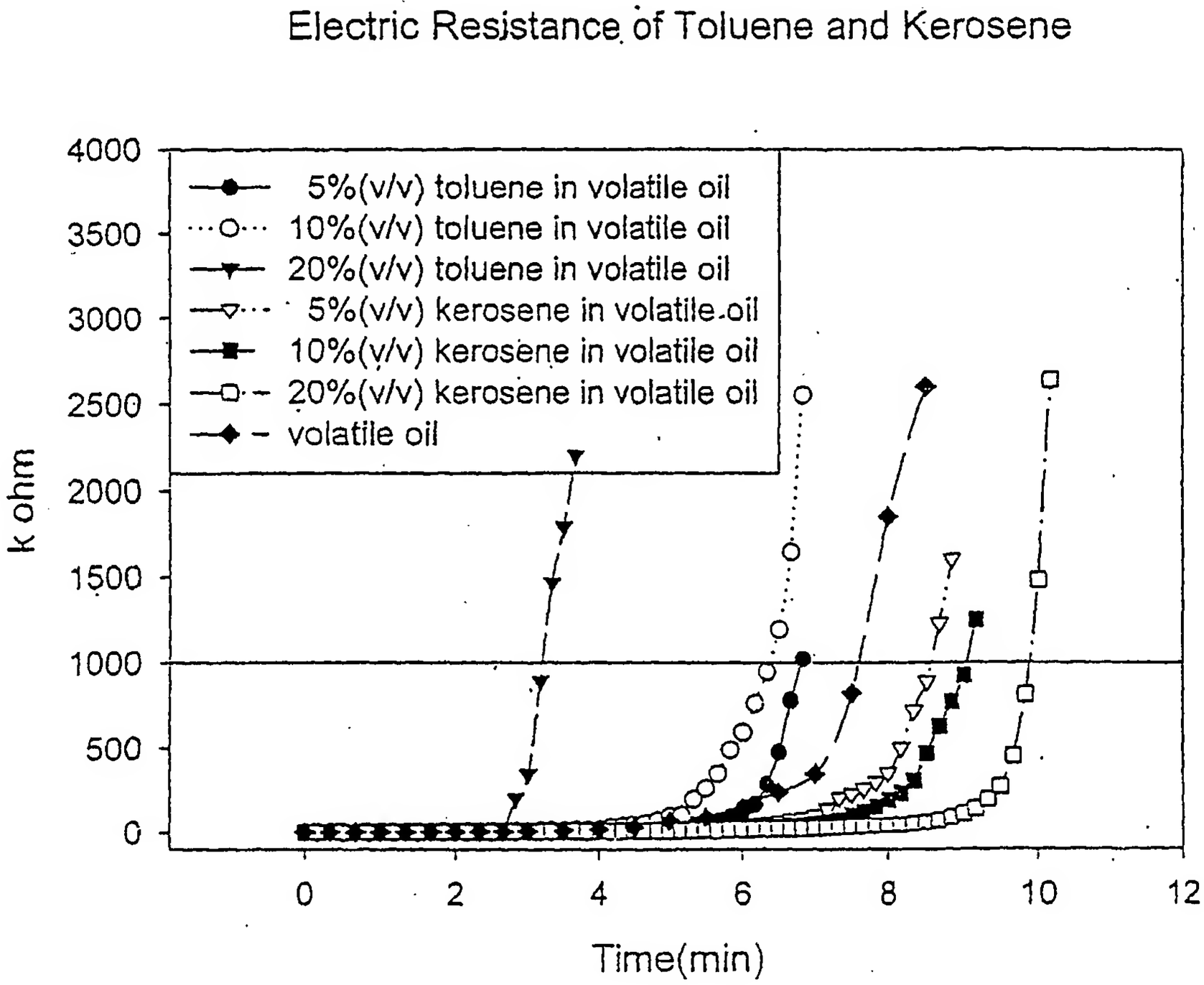
[FIG.1]



[FIG.2]



[FIG.3]


Electric Resistance of Toluene and Kerosene
5%(v/v) toluene in volatile oil
10%(v/v) toluene in volatile oil
20%(v/v) toluene in volatile oil
5%(v/v) kerosene in volatile oil
10%(v/v) kerosene in volatile oil
20%(v/v) kerosene in volatile oil
volatile oil
k ohm
4000
3500
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
Time(min)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR01/00787

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 C08L 101/12, B32B 27/32, H01B 7/17

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC7 C08L 101/12, B32B 27/32, H01B 7/17, G01N 33/28

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Korean Patents and Applications for Inventions since 1975
Korean Utility Models and Applications for Utility Models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)

NPS, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 01-51941 A (FUJI PHOTO FILM CO LTD) 28 February 1989 see the whole document	1-2
Y, P	JP 12-315423 A (FUJIKURA LTD) 14 November 2000 see the whole document	1-2
A	JP 54-105792 A (FURUKAWA ELECTRIC CO LTD) 20 August 1979 see the whole document	1-2

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☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 SEPTEMBER 2001 (27.09.2001)	28 SEPTEMBER 2001 (28.09.2001)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office Government Complex-Daejeon, Dunsan-dong, Seo-gu, Daejeon Metropolitan City 302-701, Republic of Korea Facsimile No. 82-42-472-7140	BAHN, Yong Byung Telephone No. 82-42-481-5547

Form PCT/ISA/210 (second sheet) (July 1998)